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Laboratorijske vježbe iz predmeta Upravljanje u
realnom vremenu

Current shunt and differential voltage, timer interrupt

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Slika 1. Vernier Current Shunt Probe



Slika 2 . Vernier Differential Voltage Probe

Problem Description

At first we used Vernier current shunt probe with timer interrupt. Timer interrupt is used in real time controlled systems for performing tasks at specific period of time without interfering with the rest of the code. They are useful in measuring signal at equal time intervals, calculating those intervals, sending a signal of a specific frequency etc.

In this specific case, we used it with Vernier current shunt probe to measure electrical current of DC power supply.

We connected current shunt probe serial to two resistors of ~ 40 Ohms, and connected it to DC power supply. Vernier current shunt was connected to Arduino via Vernier Interface Shield which we used to display results on serial monitor and graph those results on serial plotter. Considering that maximum voltage on any input on this probe was 10V, we changed output voltage from 0V to 10V and then compared measurements on DC power supply to values displayed on Arduino IDE serial monitor, as seen on picture (5) , in order to confirm accuracy of device itself .

We repeated the same procedure with Vernier Differential Voltage Probe. The code that was used for the first probe was also used for the second probe, with difference that differential voltage probe was connected parallel, instead of serial .

Procedura ispitivanja:

Povezali smo 2 otpornika od po 40 Ohma na šant i povezali uređaj na izvor jednosmjernog napona. Uređaj je povezan na arduino posredstvom Vernier protoboard adaptera. Na taj način smo dobili rezultate mjerenja na Arduino Serial monitoru i takođe dobili mogućnost da ih grafički prikažemo na Serial Plotteru. Sa obzirom da je maksimalni raspon napona -10 do 10 V, mijenjali smo napon od 0 do 10 V i uporedili dobijene rezultate sa rezultatima prikazanim na izvoru napona, da bi provjerili tačnost samog uređaja.

Ista procedura je ponovljena sa Vernier Differential Voltage-om koristeći isti kod. Ovaj senzor je upotrijebljen za mjerenje pada napona na jednim od otpornika.

Potrebni djelovi:

- Arduino Uno ploča
- USB kabl
- Breadboard
- Otpornici 40 Ohm x2
- Current shunt probe
- Differential voltage probe
- Vernier interface shield
- Džamperi

Kod:

```
#include "VernierLib.h"
VernierLib Vernier;

//c 10Hz T=0.1s Nt=59286
//d 2Hz T=0.5s Nt=34286
//e 1Hz T=1s Nt=3036
float sensorvalue = 0;
char inChar = 'A';
unsigned int Nt = 34286; //sa 2 Hz startovanje (T=0.5 s)
boolean procitao = false;

void setup() {

  // initialize serial:
  Serial.begin(57600);
```

```

Vernier.autoID();

// initialize timer1 overflow
noInterrupts();      // disable all interrupts
TCCR1A = 0;
TCCR1B = 0;

TCNT1 = Nt;         // preload timer 65536-16MHz/256/100Hz
TCCR1B |= (1 << CS12); // 256 prescaler 64us
TIMSK1 |= (1 << TOIE1); // enable timer overflow interrupt
interrupts();       // enable all interrupts
}

void loop() {
  if (procitao && inChar == 'a') //If A/D read
  {
    Serial.println(sensorvalue);
    // Serial.println(Nt); //Print value
    procitao = false; //enable A/D read again
  }
  if (procitao == false && inChar == 'b') {
    procitao = true;
  }

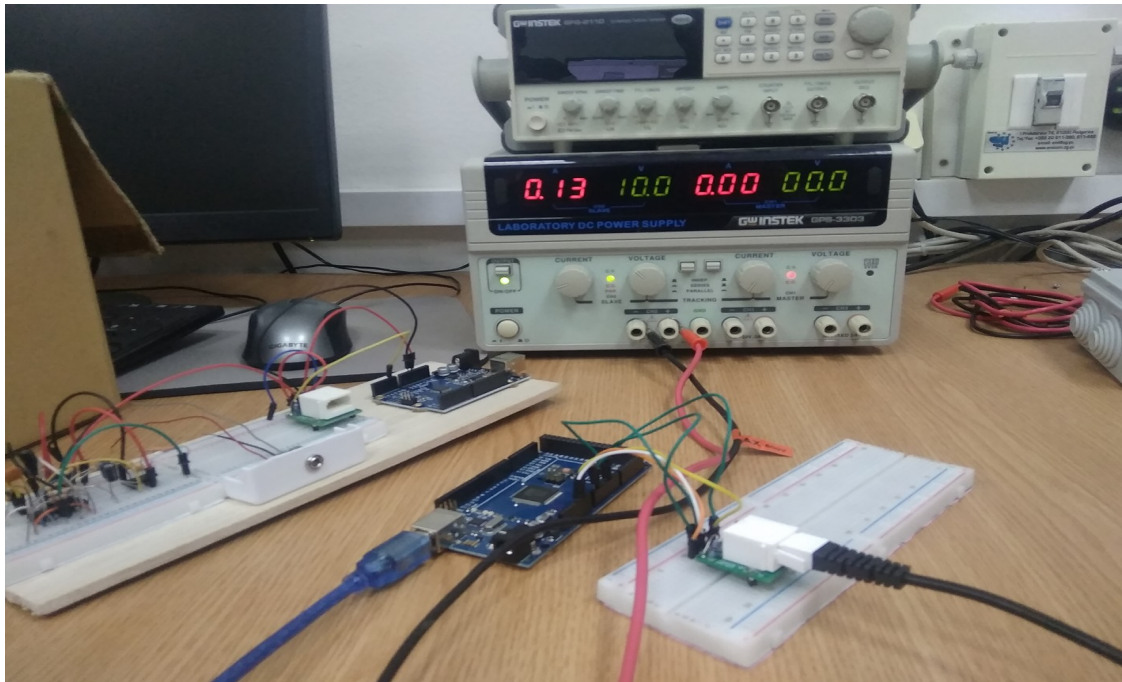
  if (procitao == true && inChar == 'c') {
    Nt = 59286; //0.1
    Serial.println(sensorvalue);
    procitao=false;}

  if (procitao == true && inChar == 'd') {
    Nt = 34286; //0.5
    Serial.println(sensorvalue);
    procitao=false;
  }
  if (procitao == true && inChar == 'e') {
    Nt = 3036; //1
    Serial.println(sensorvalue);
    procitao=false;
  }
  /* Serial event*/
}

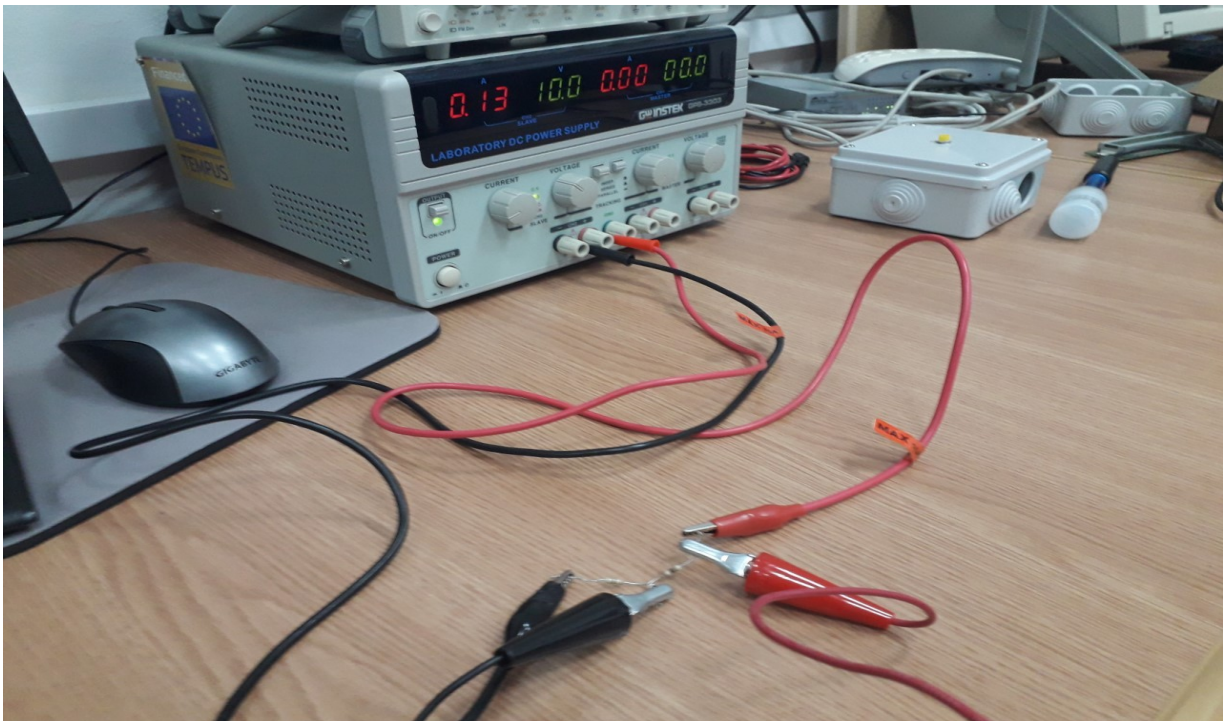
void serialEvent() {
  while (Serial.available()) {
    inChar = (char)Serial.read();
  }
}

```

```
}  
  
ISR(TIMER1_OVF_vect) {  
    TCNT1 = Nt;          // preload timer  
    sensorvalue =(Vernier.readSensor());  
    procitao = true;    //A/D read  
}
```



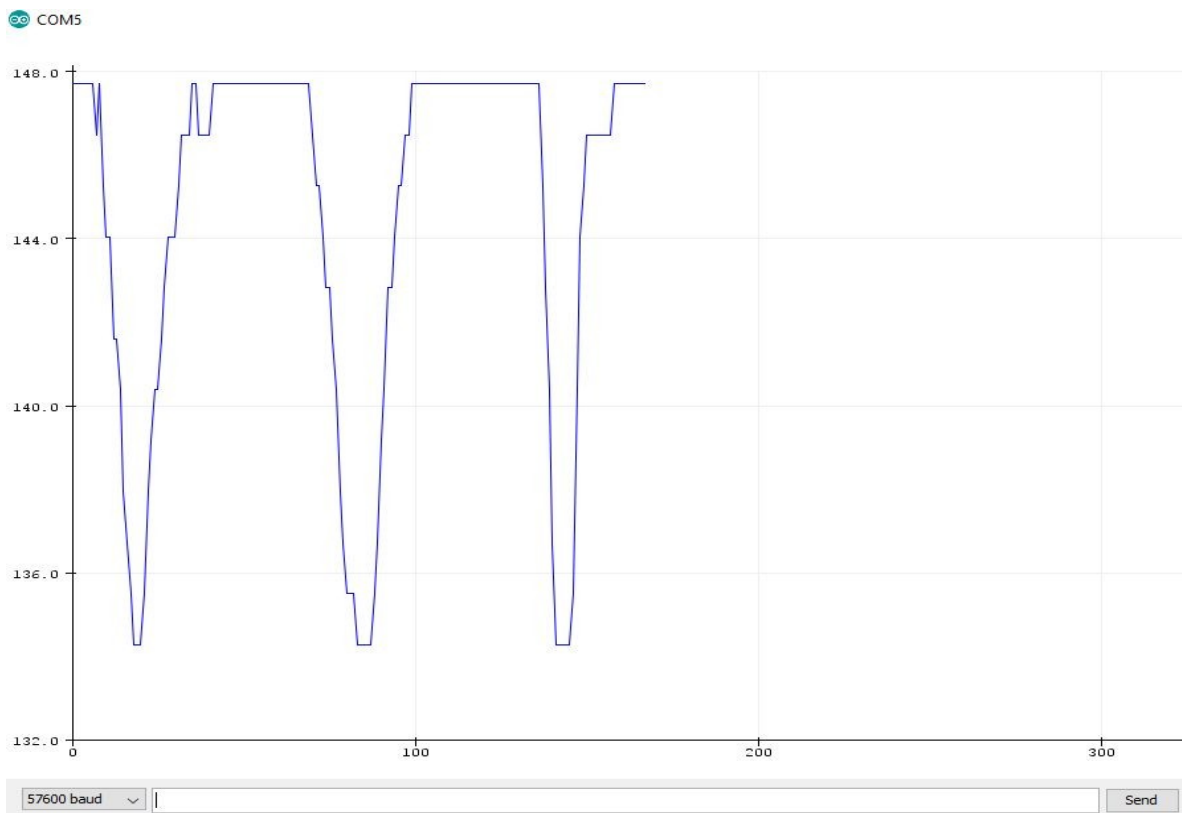
Slika 3 :povezivanje shanta na izvor DC napona



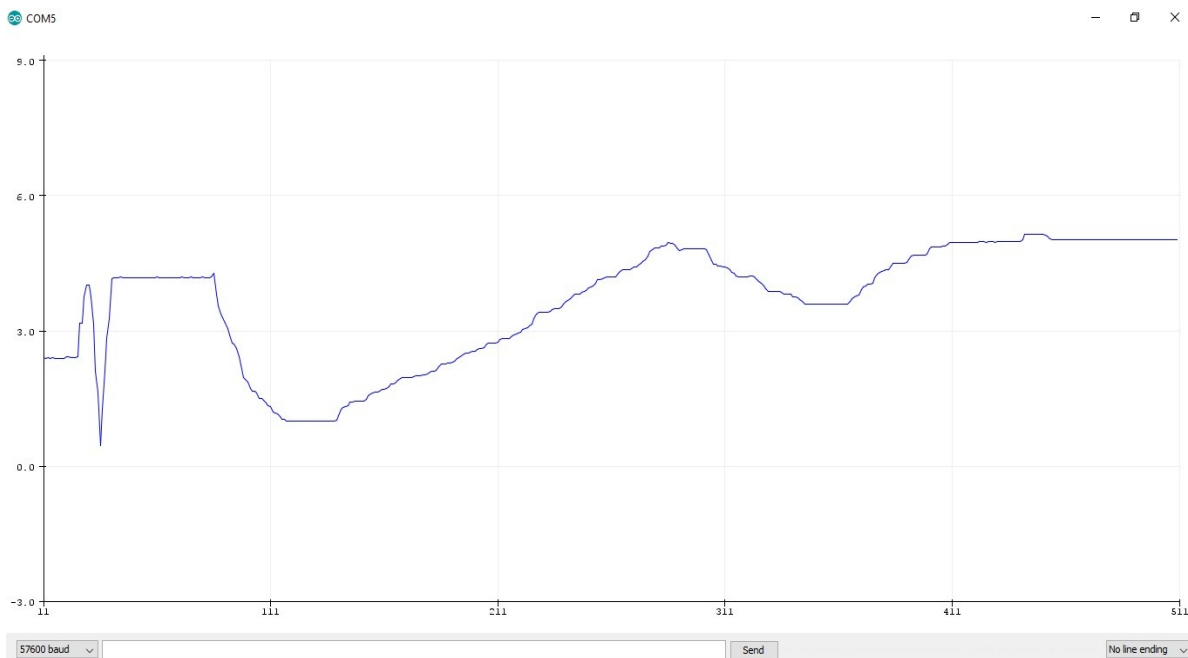
Slika 4. povezivanje differential voltage probe



Slika 5 . Očitane vrijednosti na serial monitoru za current shunt (iskazane u mA) pri $T=0.1s$



Slika 6 . Serial ploter pri promjeni napona od 9 do 10 V



Slika 7 . Serial ploter mjerenja pada napona na otporniku od 40 ohma pri promjeni napona napajanja

